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Microbotryum bardanense and *M. polygoni-alati* —new records from Nepal

Teodor T. Denchev[1], Suk-Pyo Hong[2], Cvetomir M. Denchev[1*]

[1] *Institute of Biodiversity and Ecosystem Research, Bulgarian Academy of Sciences, 2 Gagarin St., 1113 Sofia, Bulgaria*

[2] *Laboratory of Plant Systematics, Department of Biology, Kyung Hee University, Seoul, 02447, Republic of Korea*

* Correspondence to: *cmdenchev@yahoo.co.uk*

Abstract—Two smut fungi, *Microbotryum bardanense* and *M. polygoni-alati,* are reported for the first time from Nepal. Descriptions, illustrations, and taxonomic notes are provided for these taxa.

Key words—*Caryophyllaceae, Microbotryaceae, Persicaria nepalensis, Polygonaceae, Silene moorcroftiana*

Introduction

In its broad circumscription, *Microbotryum* Lév. comprises 99 species (Kemler & al. 2020). This genus has a nearly world-wide range, but many of its species are known from one or a limited number of localities (Vánky 2011, 2013). Some of them are undoubtedly under-recorded and in need of additional distribution data, especially from some understudied regions of the world, such as the Himalayas.

During examinations in the herbarium of the Royal Botanic Garden Edinburgh, UK (E) and T.B. Lee Herbarium in College of Agriculture and Life Sciences, Seoul National University, Seoul, Korea (SNUA), carried out by one of the authors (CMD), some specimens from Nepal, infected by smut fungi, were found. Two rarely collected smut fungi, *Microbotryum bardanense* and *M. polygoni-alati,* are reported here for the first time from Nepal.

Materials & methods

Dried specimens from E and SNUA were examined under light microscope (LM) and scanning electron microscope (SEM). For LM observations and measurements, spores were mounted in lactoglycerol solution (w : la : gl = 1 : 1 : 2) on glass slides, gently heated to boiling point to rehydrate the spores, and then cooled. The spore measurements are given as min–max (mean ± standard deviation). For SEM, spores were attached to specimen holders by double-sided adhesive tape and coated with gold in an ion sputter. The surface structure of spores was observed and photographed at 10 kV accelerating voltage using a JEOL SM-6390 scanning electron microscope. The height of warts was measured in LM. The descriptions below are based entirely on the specimens examined. The lists of shapes of spores are arranged in descending order of frequency.

Taxonomy

Microbotryum bardanense Chleb. & Suková, Mycotaxon 93: 150, 2005. Fig. 1

Infection systemic. Sori in considerably swollen anthers, filling pollen sacs with a pulverulent, dark brick (based on Rayner 1970) or purplish date (based on the Colour identification chart of Anonymous 1969) spore mass. Spores subglobose, globose, broadly ellipsoidal or ovoid, sometimes ellipsoidal, (5–)5.5–7(–8) × (4.5–)5–6.5(–7) µm (6.4 ± 0.5 × 5.8 ± 0.4 µm) (n = 100), light vinaceous; wall irregularly, moderately verruculose to incompletely reticulate, 0.7–1.1 µm thick, including 0.3–0.5 µm high ornamentation. In SEM, spore wall moderately echinulate-verruculose, ornaments often confluent, forming short rows or interconnected by lower ribs forming irregular patterns, sometimes even incomplete reticulum.

Specimens examined—On *Silene moorcroftiana* Wall. ex Benth.: **NEPAL, Gandaki Pradesh, Mustang District,** Jharkot–Khinga–Yekle Bhatti–Jomsom–Syang–Marpha, 28°45′17″–49′01″N 83°41′28″–51′02″E, alt. 3100 m, 21 August 1994, leg. S. Noshiro & al., 1994 Expedition by the Society of Himalayan Botany, Tokyo, no. 9470526 (E 232984); Jomsom–Ekle Bhatti–Khingar–Jharkot, 28°47′09″–49′38″N 83°42′5″–51′07″E, alt. 3040 m, 22 September 1995, leg. M. Mikage & al., 1995 Expedition by the Herbal Garden, Kanazawa Univ., Japan, no. 9552385 (E 232977).

Distribution—On *Caryophyllaceae: Silene moorcroftiana,* the Himalayas (India (Ladakh) and Nepal).

Comments—The morphological features given in the protologue of *M. bardanense* (Chlebicki & Suková 2005) are similar to those reported here.

Silene moorcroftiana is distributed in Afghanistan, NW Pakistan, India (Jammu and Kashmir, Himachal Pradesh, and Uttar Pradesh), Nepal, and China (Tibet) (Zhou & al. 2001, Rajbhandari & Suzuki 2008, India

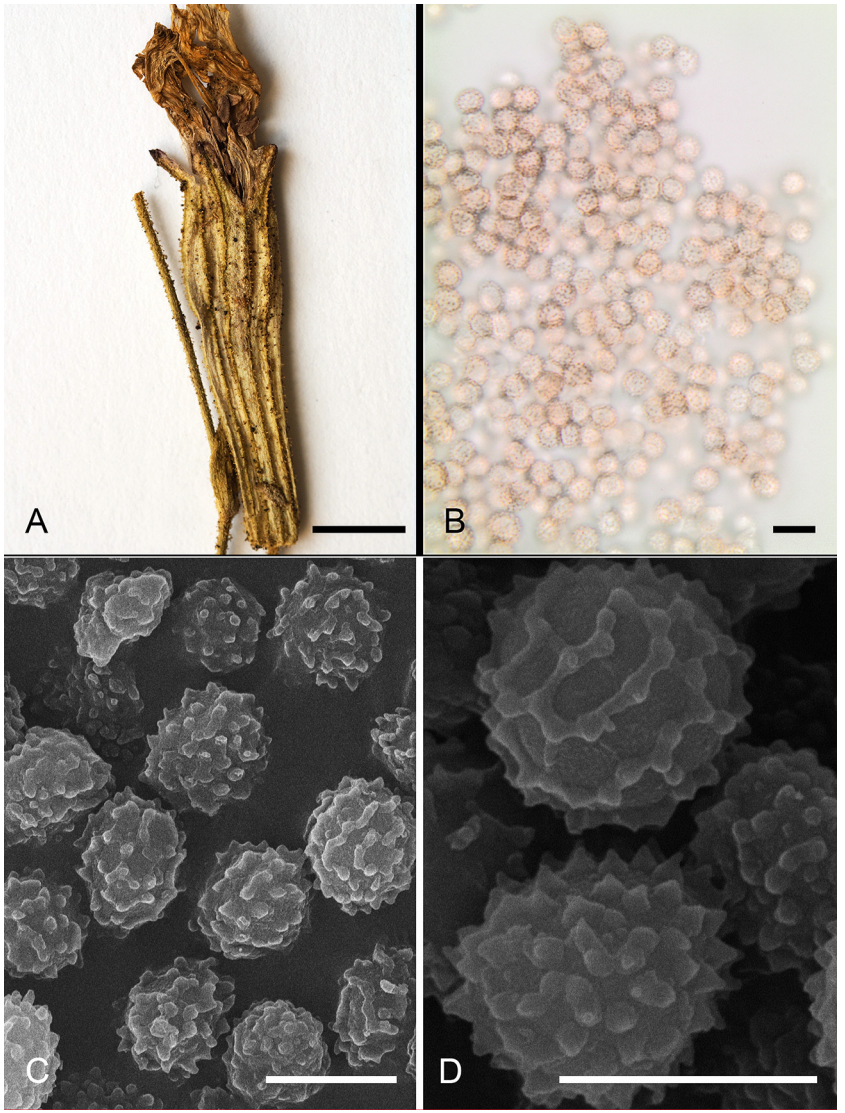

Fig. 1. *Microbotryum bardanense* on *Silene moorcroftiana* (E 232984): A. Habit; B. Spores in LM; C, D. Spores in SEM. Scale bars: A = 0.5 cm; B = 10 µm; C, D = 5 µm.

Biodiversity Portal 2020). Until now, *Microbotryum bardanense* was known only from its type locality: India, Ladakh, 20 km S of Padum, near Bardan

Monastery, alt. 3888 m (Chlebicki & Suková 2005). In the protologue, the geographic coordinates of the type locality appear to be wrong. *Microbotryum bardanense* is reported here for the first time from Nepal.

Microbotryum polygoni-alati (Thirum. & Pavgi) Vánky,
Mycotaxon 67: 49, 1998 Fig. 2

Sori in inflorescence (destroying single or groups of flowers, forming irregular bodies), in some leaves (forming irregular bodies), or on stem (forming irregular or reniform bodies); 2–10 mm long, covered by a yellow-brown peridium that ruptures irregularly, exposing a semi-agglutinated to powdery, sepia (based on Rayner 1970) or date brown (based on the Colour identification chart of Anonymous 1969) spore mass. Spores subglobose, globose, broadly ellipsoidal, slightly irregular, ellipsoidal or ovoid, 9–12.5(–14) × (8.0–)8.5–11(–12) µm (10.9 ± 0.9 × 9.6 ± 0.6 µm) (n = 100), light to medium purplish brown; wall reticulate, 1.0–1.4 µm thick, including 0.4–0.6(–0.7) µm high muri. In SEM, spore wall reticulate, often incompletely reticulate, often with warts, mainly in the common points of the meshes; the interspaces often perforate with up to 3(–5) holes per interspace, sometimes with 1(–2) warts. Immature spores abundant, hyaline to light purplish brown, smaller than the mature spores.

Specimen examined—On *Persicaria nepalensis* (Meisn.) Miyabe: **NEPAL, Province No. 1, Khumbu Region,** Rolwaling, trekking to Sagarmatha National Park, Lukla (alt. 2760 m) to Phakding (alt. 2610 m) ca 5 km, 27°41′44″N 86°44′19″E, 14 October 2002, leg. C.S. Chang & al., no. NE020610 (SNUA 61760; host plant as "*Koenigia nepalensis* D. Don", rev. S.P. Hong).

Distribution—On *Polygonaceae: Persicaria nepalensis* [≡ *Polygonum nepalense* Meisn.; = *P. alatum* Buch.-Ham. ex D. Don]; Asia (India, Nepal, China), East Africa (Ethiopia).

Comments—The morphological features of the examined specimen are similar to those reported by Vánky (2011). *Microbotryum polygoni-alati* has very characteristic spore wall ornamentation (visible particularly well in SEM) – a reticulum with interspaces, which are often perforate with ≤3(–5) holes, sometimes, with 1(–2) warts. This species is also one of the few members of *Microbotryum* that can develop sori in different organs of their hosts.

Persicaria nepalensis is distributed in East, South, and Southeast Asia, New Guinea, and Tropical Africa (Li & al. 2003) but this species has been introduced in many other regions of the world. *Microbotryum polygoni-alati* was known only from India (Thirumalachar & Pavgi 1968; Vánky 2007), China (Sichuan,

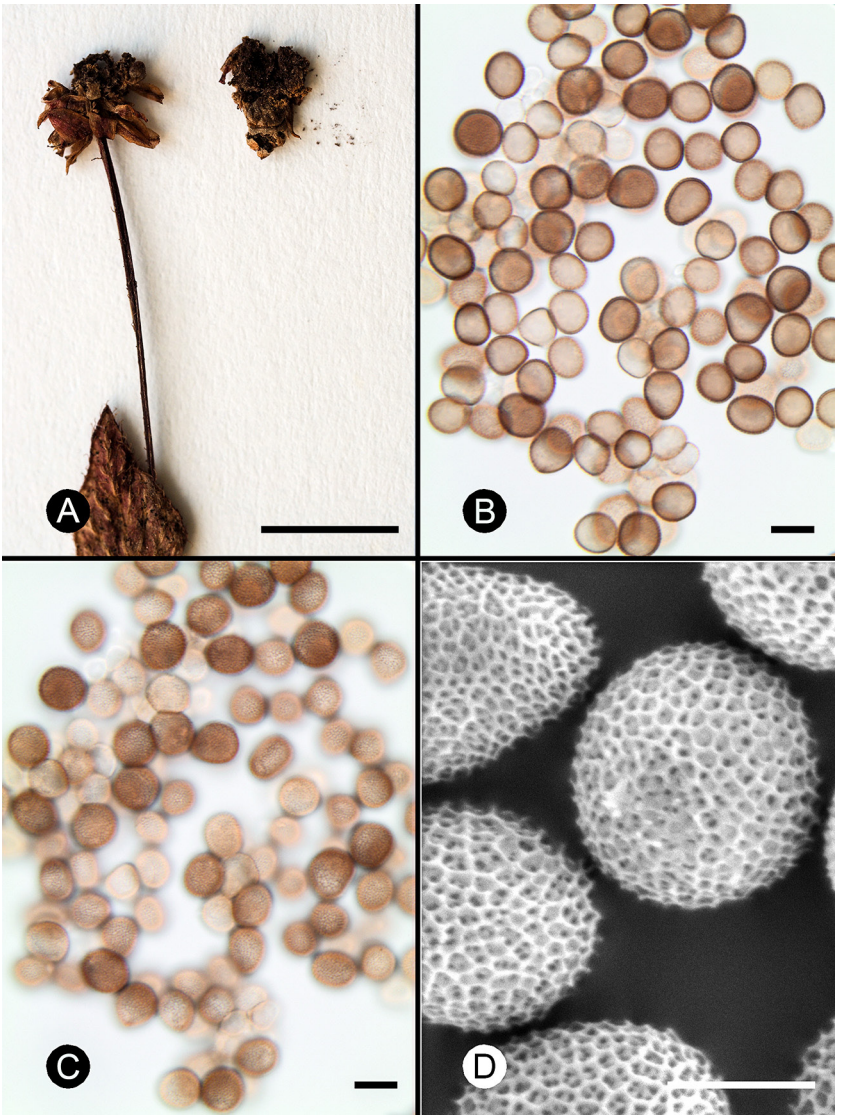

Fig. 2. *Microbotryum polygoni-alati* on *Persicaria nepalensis* (SNUA 61760): A. Habit; B. Spores in LM, median view; C. Spores in LM, surface view; D. Spores in SEM. Scale bars: A = 0.5 cm; B, C = 10 μm; D = 5 μm.

Guo 1993; Yunnan, Kakishima & al. 2000), and Ethiopia (Denchev & Denchev 2017). It is reported here for the first time from Nepal.

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